

# **Global Urban Observation (I): International Collaboration Opportunities**

## **NASA GEO Subtask SB-04**

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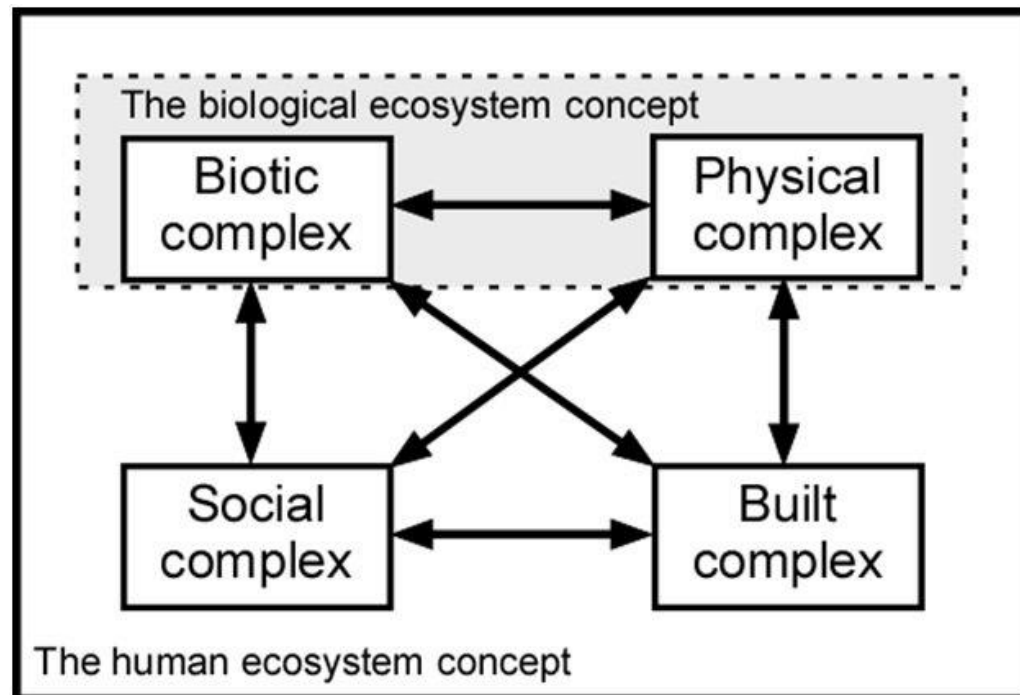
National Space Science and Technology Center

Huntsville, AL

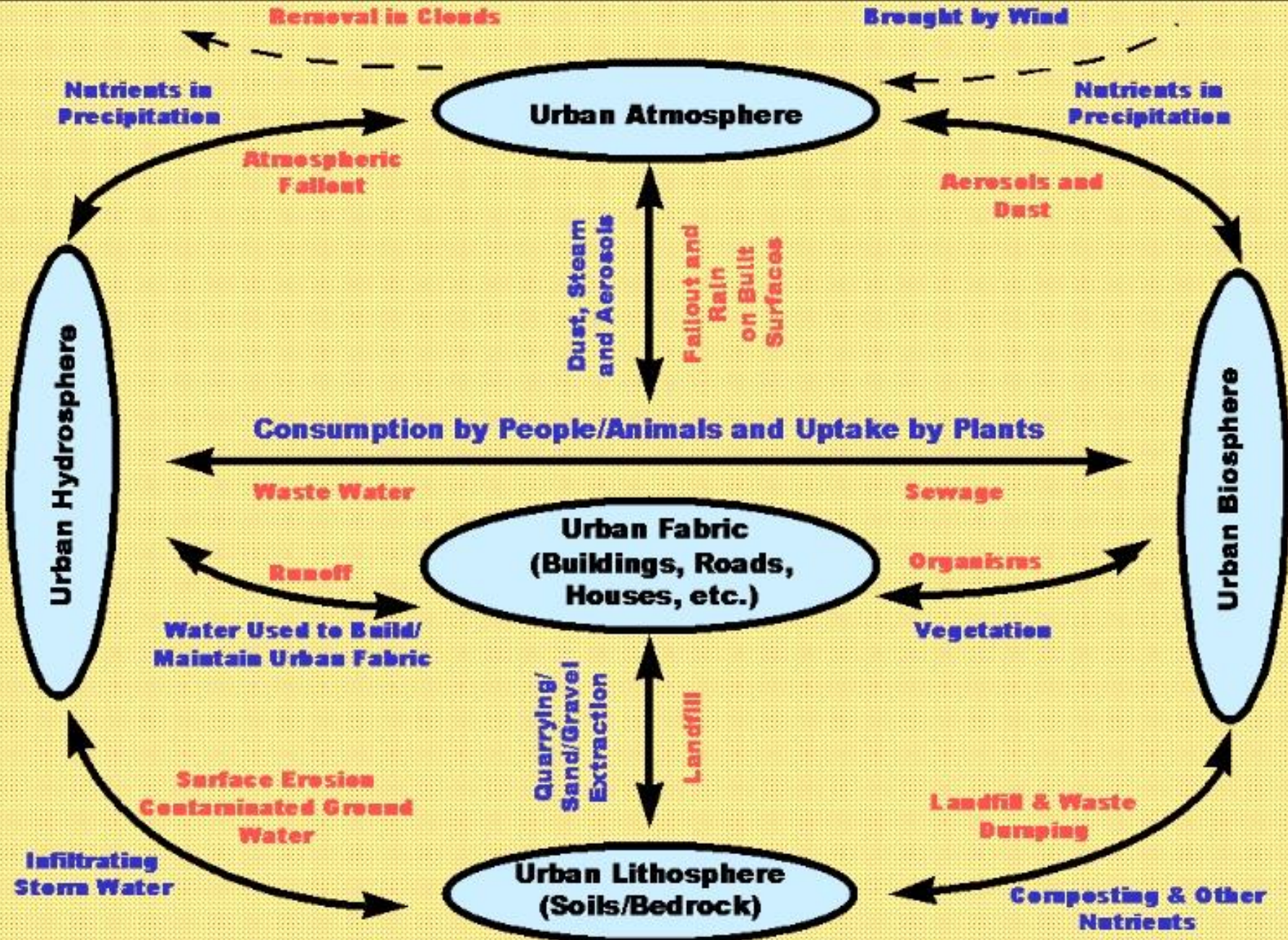
AAG 2015 Annual Meeting – April 21-25, 2015



- In studying urban areas, it is useful to analyze the urban environment as an 'urban ecosystem' to provide perspectives on how the various physical, biophysical, land-atmosphere, and social aspects of urban areas act as a synergistic whole to create 'the city'.
- The urban ecosystem is complex and must be broken up into its constituent parts to examine the linkages between the cycles that function within the overall ecosystem.





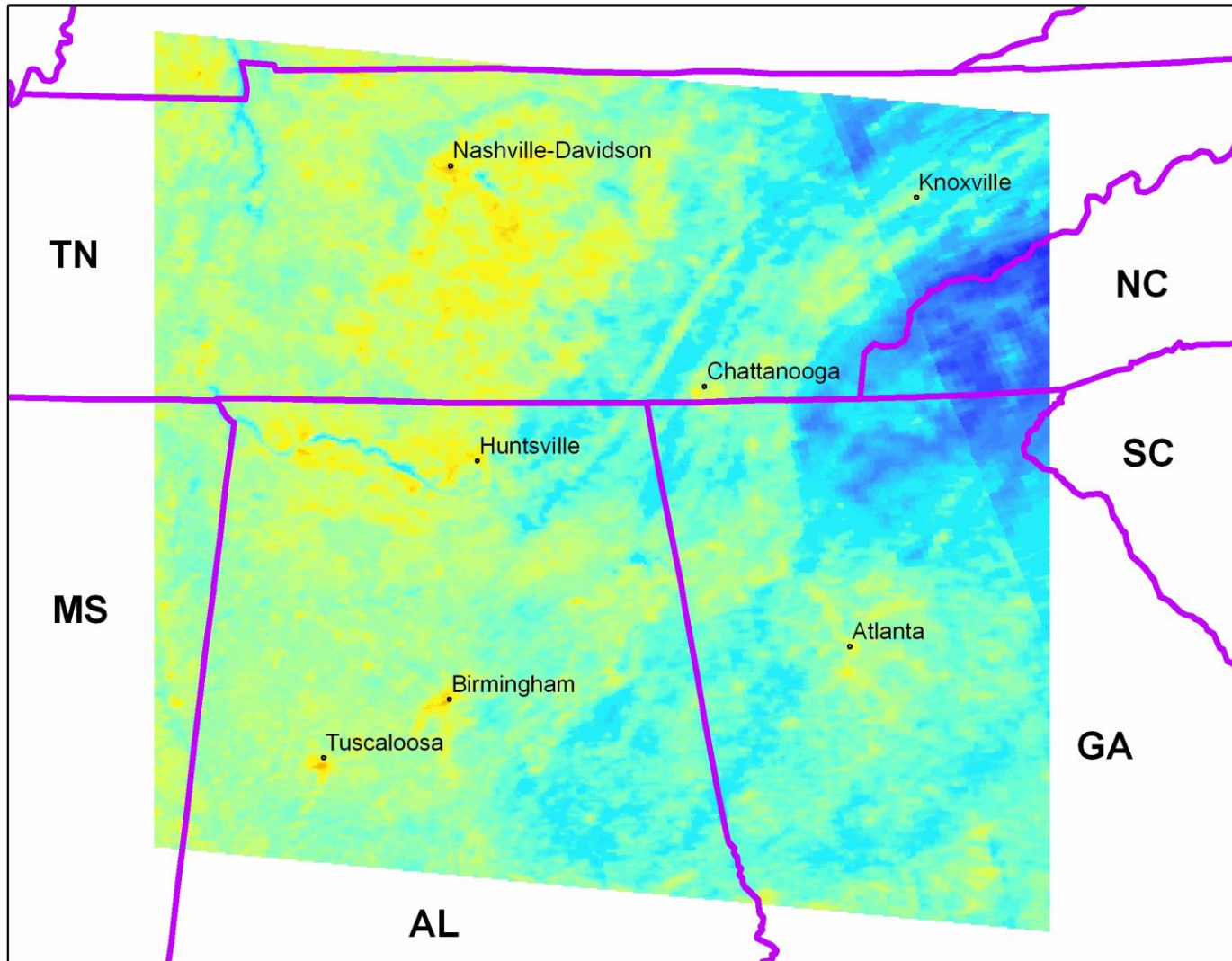




- Intrinsic to SB-04 is to produce up-to-date information on the state and dynamics of urban ecosystems from local to global scales.
- Within this context, the observation and assessment of how cities grow and change in land cover/land use through time, and how this growth affects the land-atmosphere interactions is paramount.
- Satellite data are of critical importance to observe and measure how changes in the urban surface affect land surface-atmosphere energy exchanges.

- A key component that governs the cycling of energy between the urban atmosphere, biosphere, hydrosphere, and land surface (urban fabric) is the Urban Heat Island effect (UHI).
- Integral to understanding the dynamics of the UHI is how urban growth and change in land cover/land use impact the factors that drive the UHI effect.
- SB-04 will serve as a fulcrum for collecting data from many different satellite platforms at varying spectral, spatial and temporal resolutions for use in observing, measuring, and modeling the characteristics that force the development of the UHI.

# NASA/MODIS Land Surface Temperature at 1:30 PM (June 27, 2012)



Degrees Fahrenheit

134

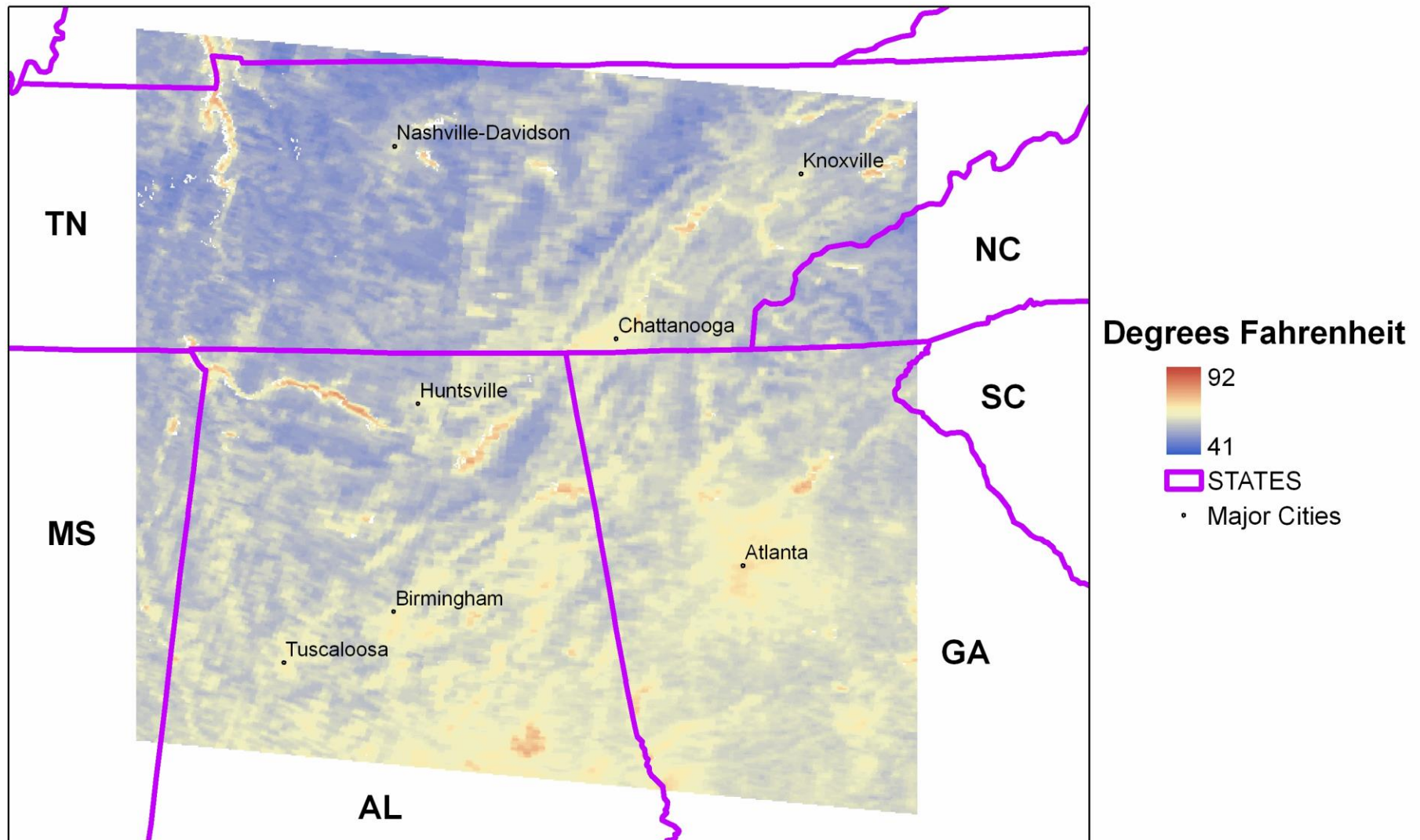
65

STATES

• Major Cities



# NASA/MODIS Land Surface Temperature at 1:30 AM (June 27, 2012)

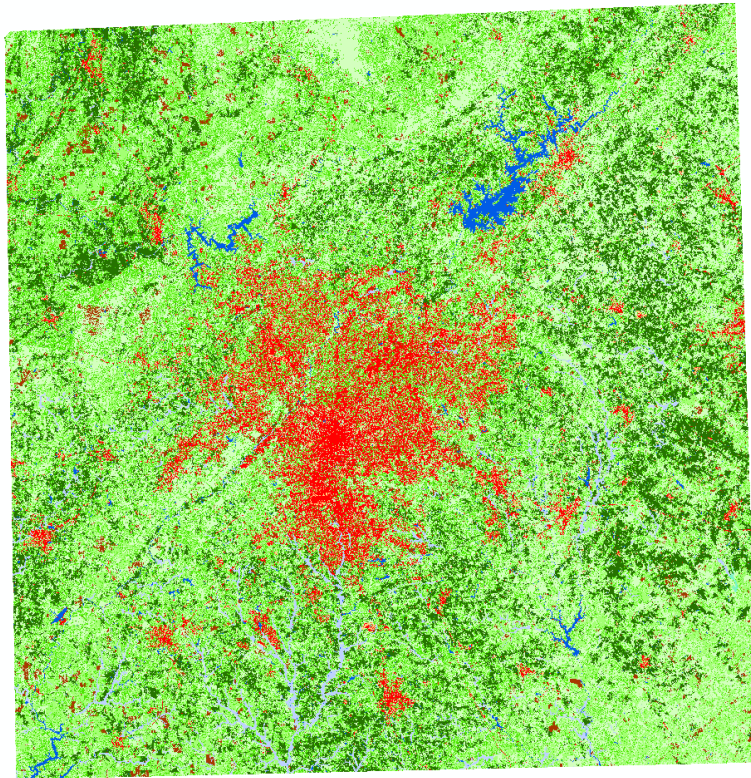


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July 17, 2012

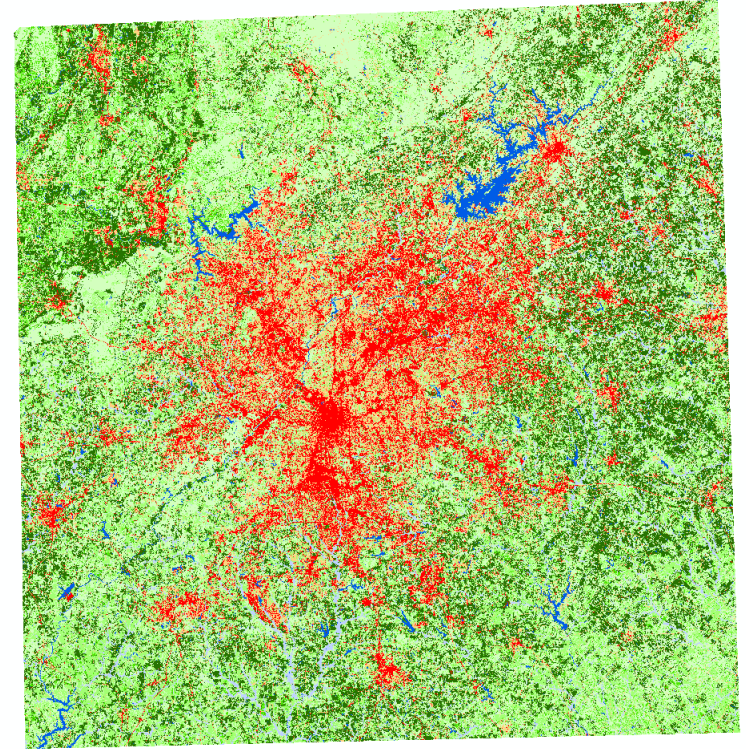




# Landsat-derived (NLCD) land cover for the Atlanta metropolitan area for 1992 and 2006



1992

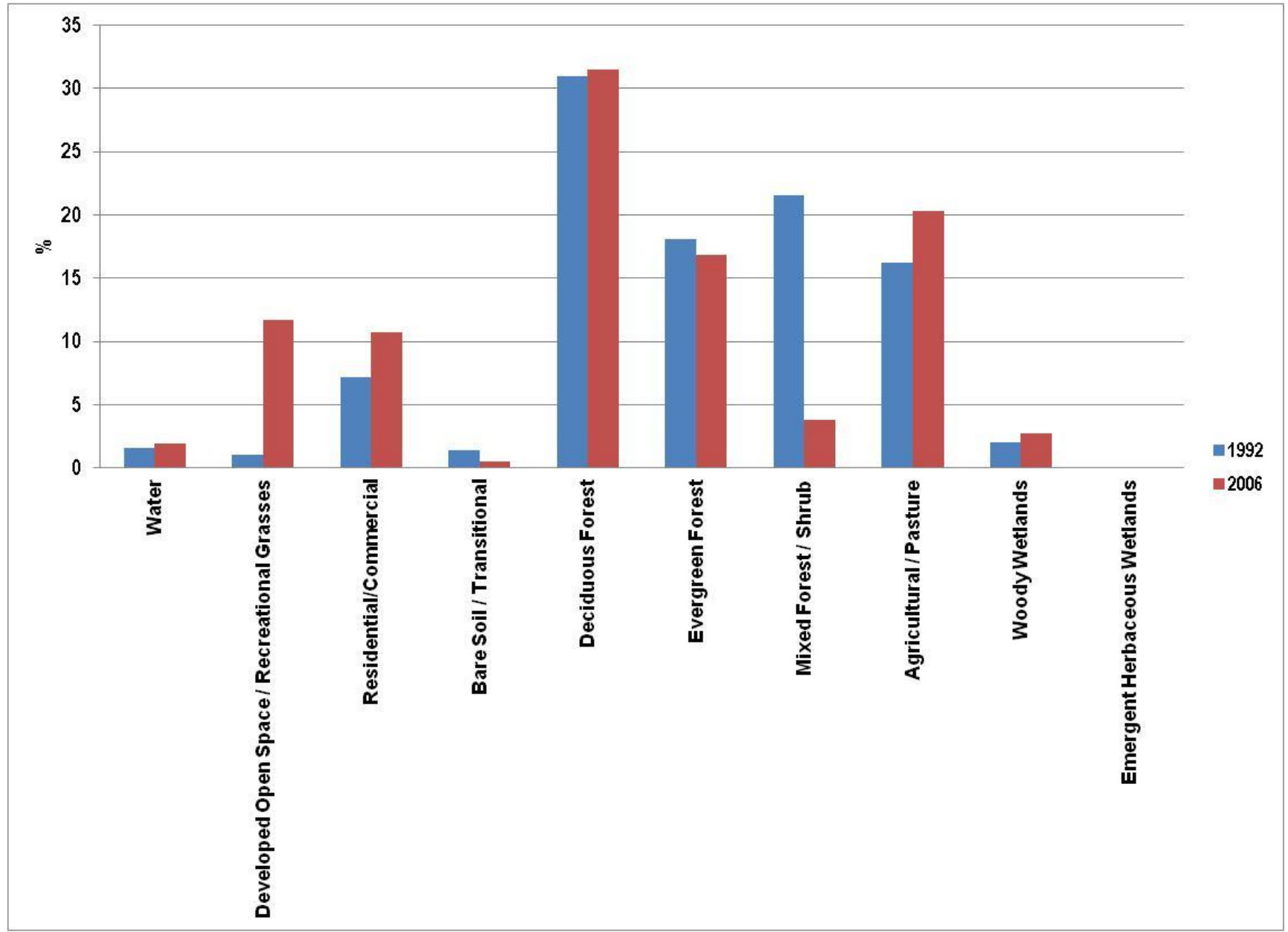


2006

-  Water
-  Developed Open Space/Recreational Grasses
-  Residential/Commercial
-  Bare Soil / Transitional
-  Deciduous Forest
-  Evergreen Forest
-  Mixed Forest / Shrub
-  Agricultural / Pasture
-  Woody Wetlands
-  Emergent Herbaceous Wetlands

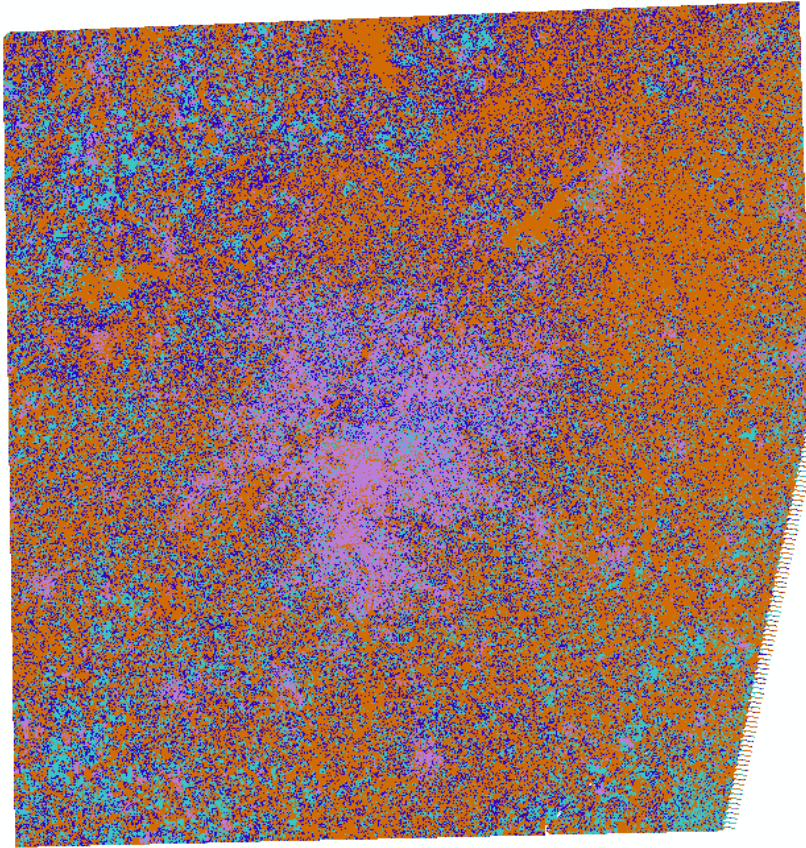


# Landsat-derived (NLCD) land cover for the Atlanta metropolitan area for 1992 and 2006

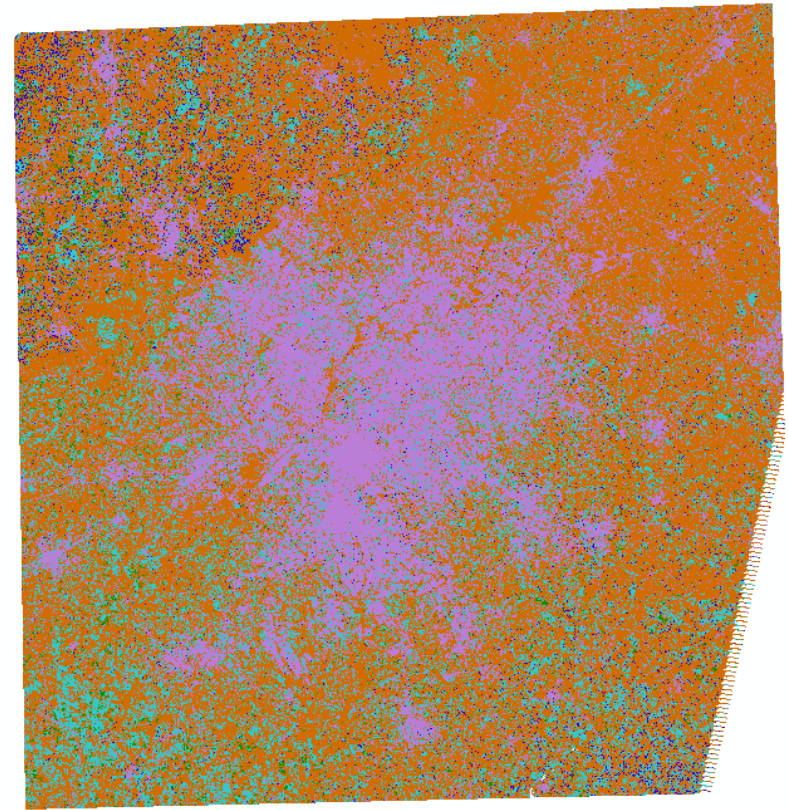


# Landsat-derived Emissivity for the Atlanta metropolitan area for 1992 and 2006

1992



2006



## Emissivity

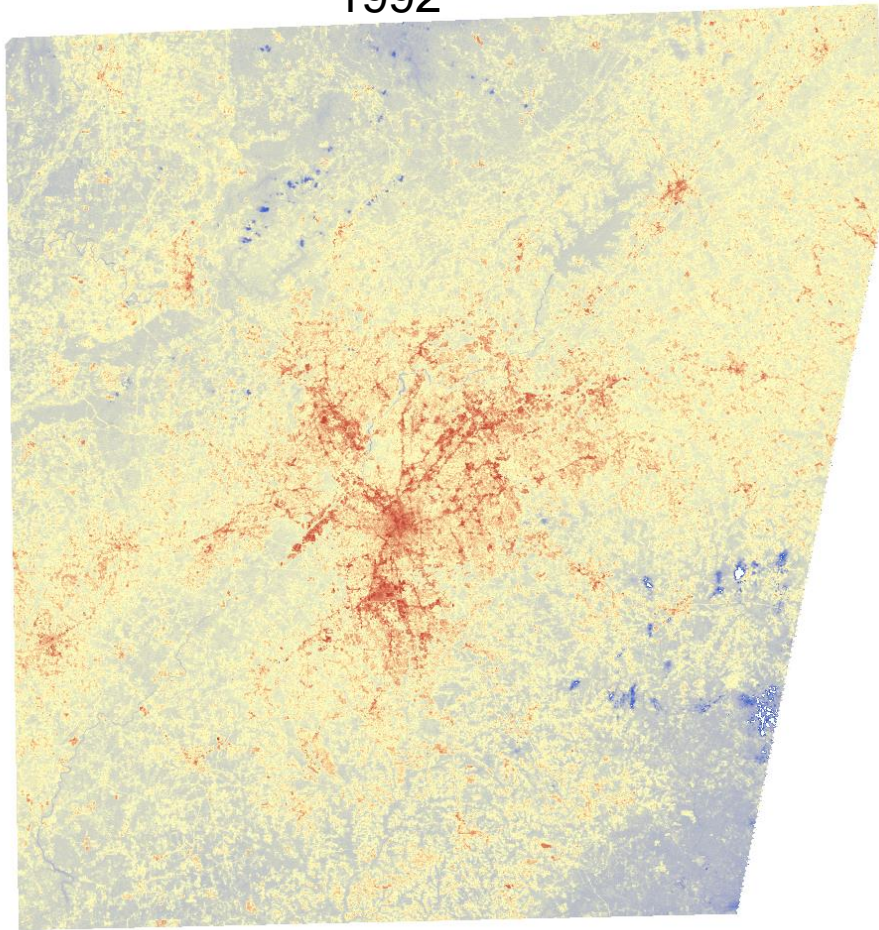
- 0.969 (Used for Bare Soil; and Developed Pixels)
- 0.974 (Used for Shrub Pixels)
- 0.980 (Used for Crops Pixels)
- 0.989 (Used for Deciduous Forests (assuming they're mostly Broadleaf); Wetlands, and Water Pixels)
- 0.9895 (Used for Mixed Forests Pixels)
- 0.990 (Used for Evergreen Pixels (assuming they're mostly Needle))

Based on a look-up table in Snyder et al. 1998 and given that our analysis is for a period when the vegetation is green.

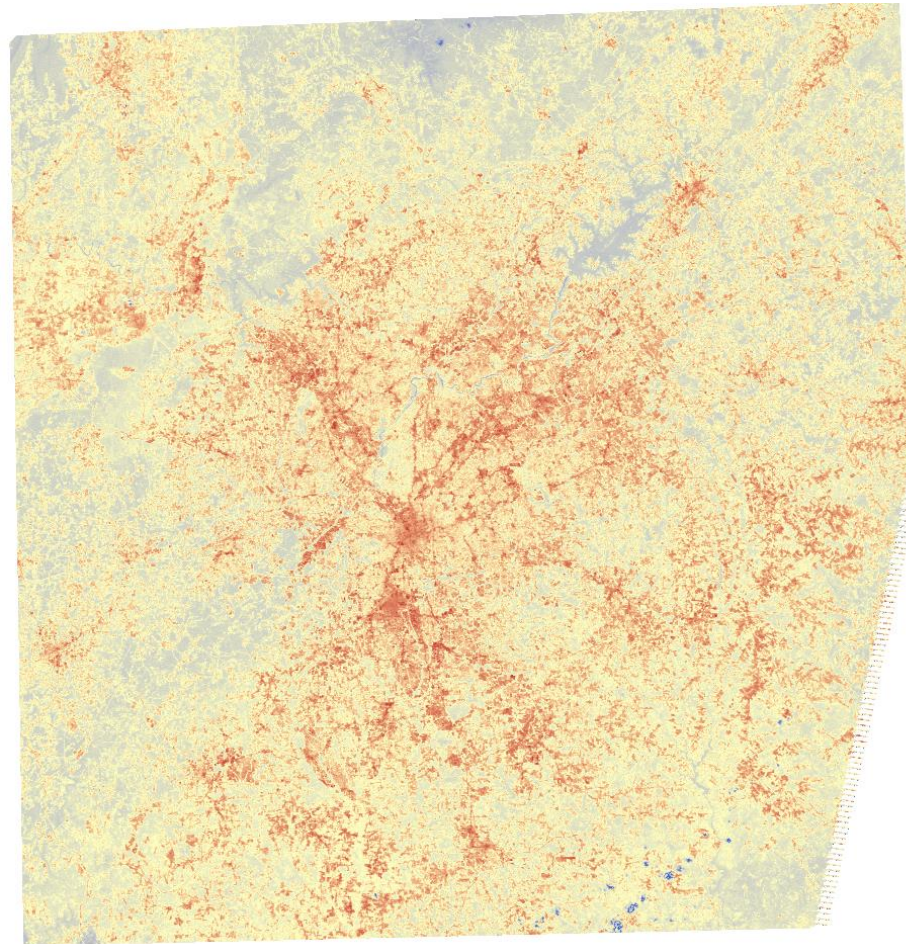


# Landsat-derived LST for the Atlanta metropolitan area for 1992 and 2006

1992



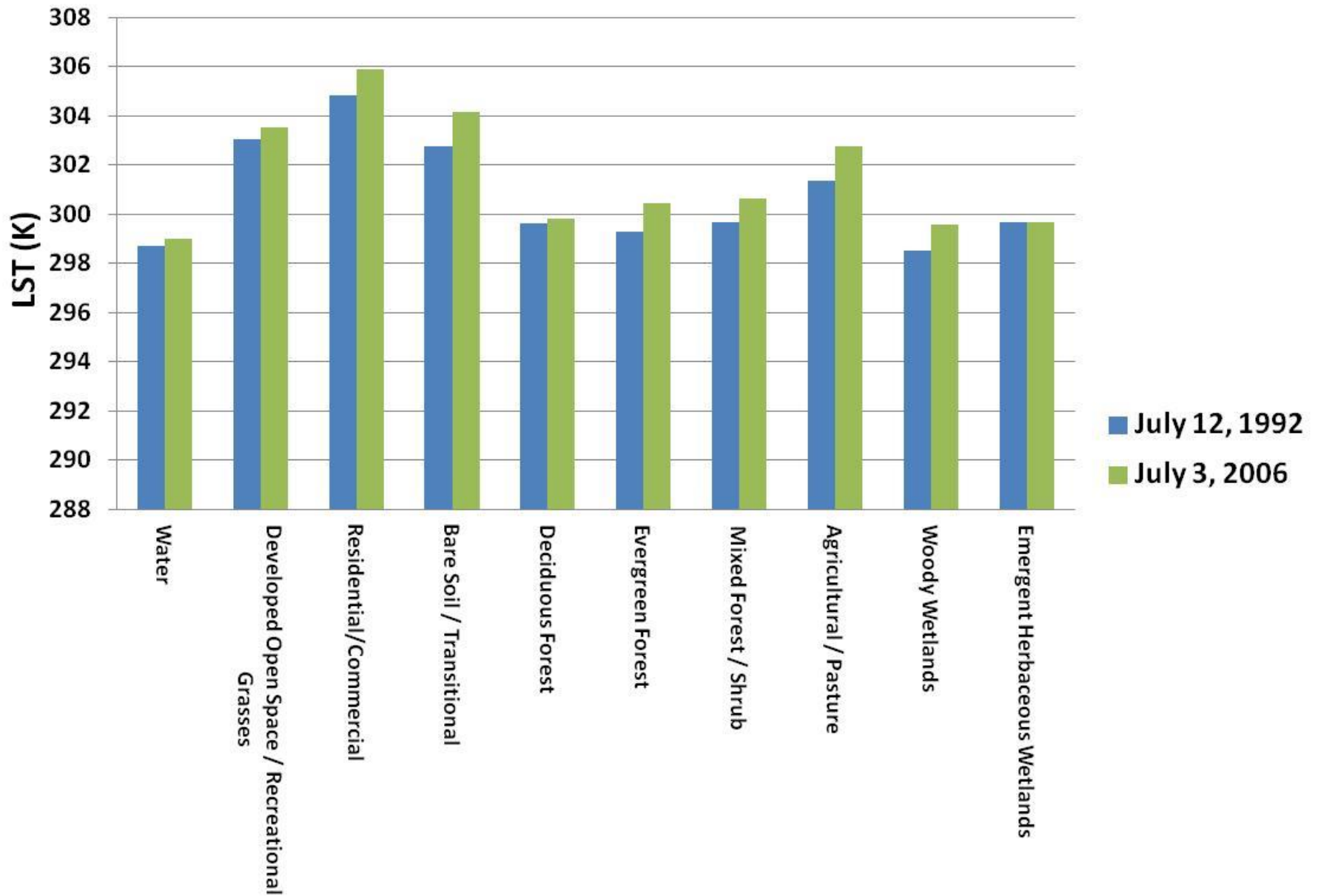
2006



LST (K)

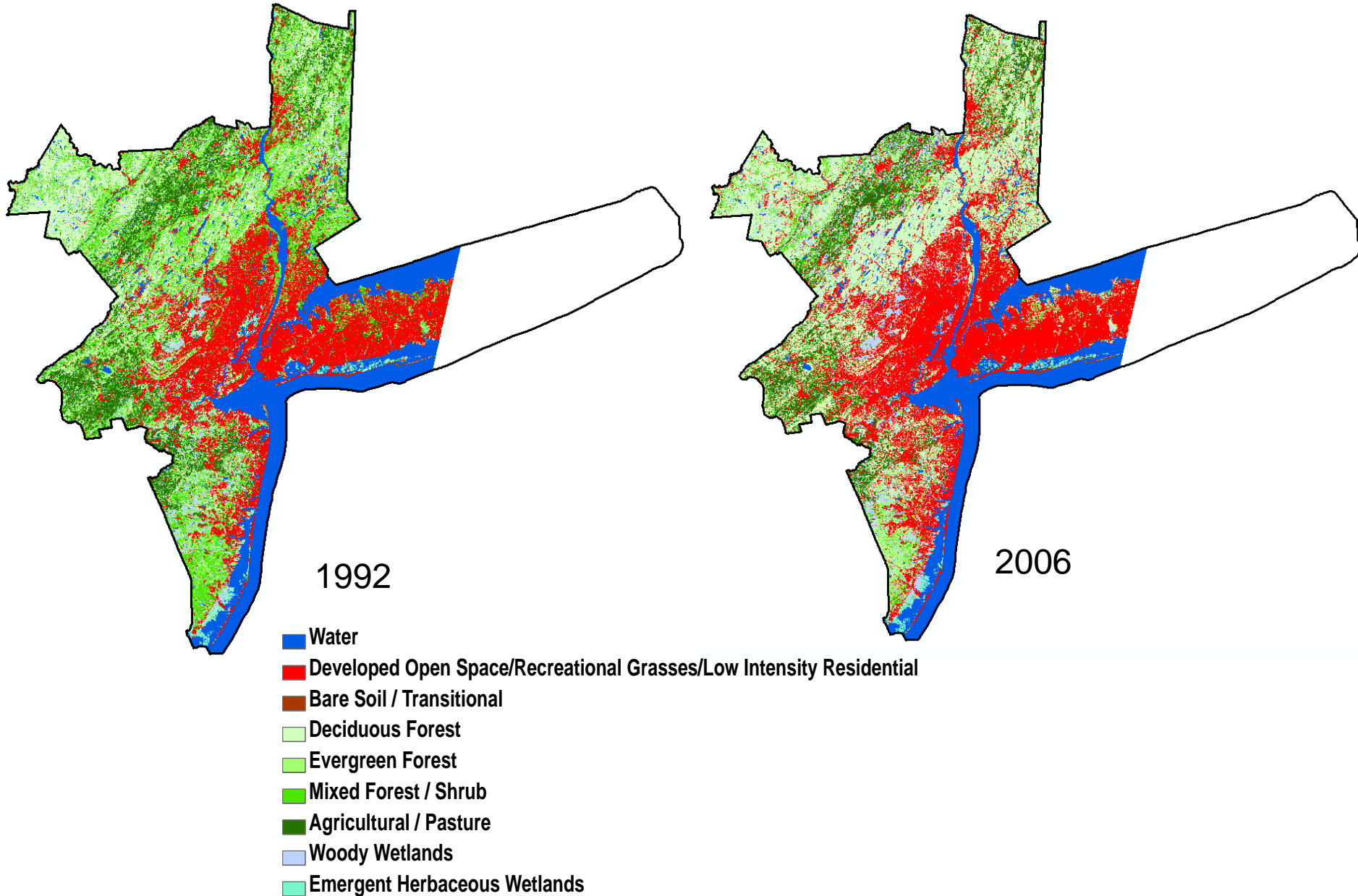


**Spatial Mean Landsat-derived LST Per LCLU Class**

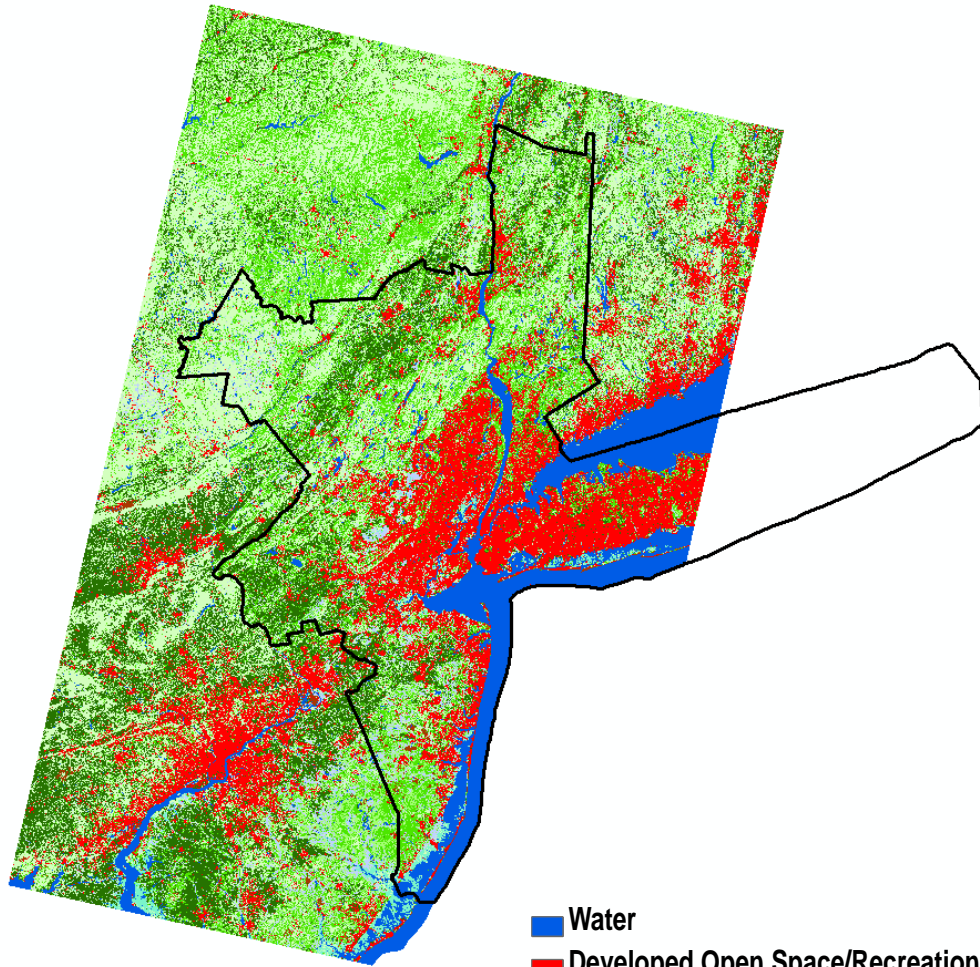




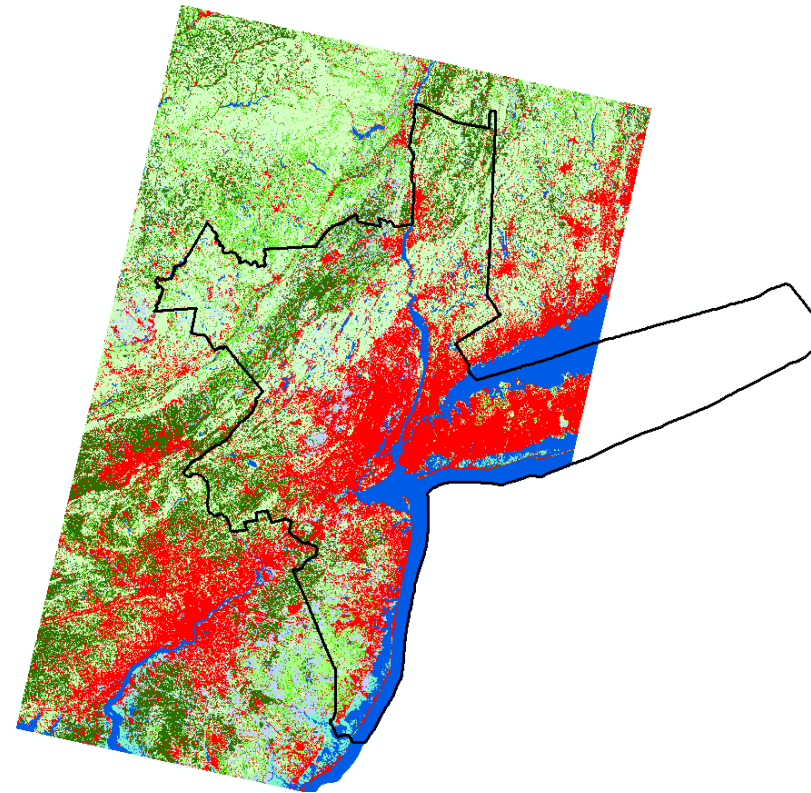
# Landsat-derived land covers for 1992 and 2006 – New York City East Tile



# Landsat-derived land cover (NLCD) for the New York City metropolitan area for 1992 and 2006



1992

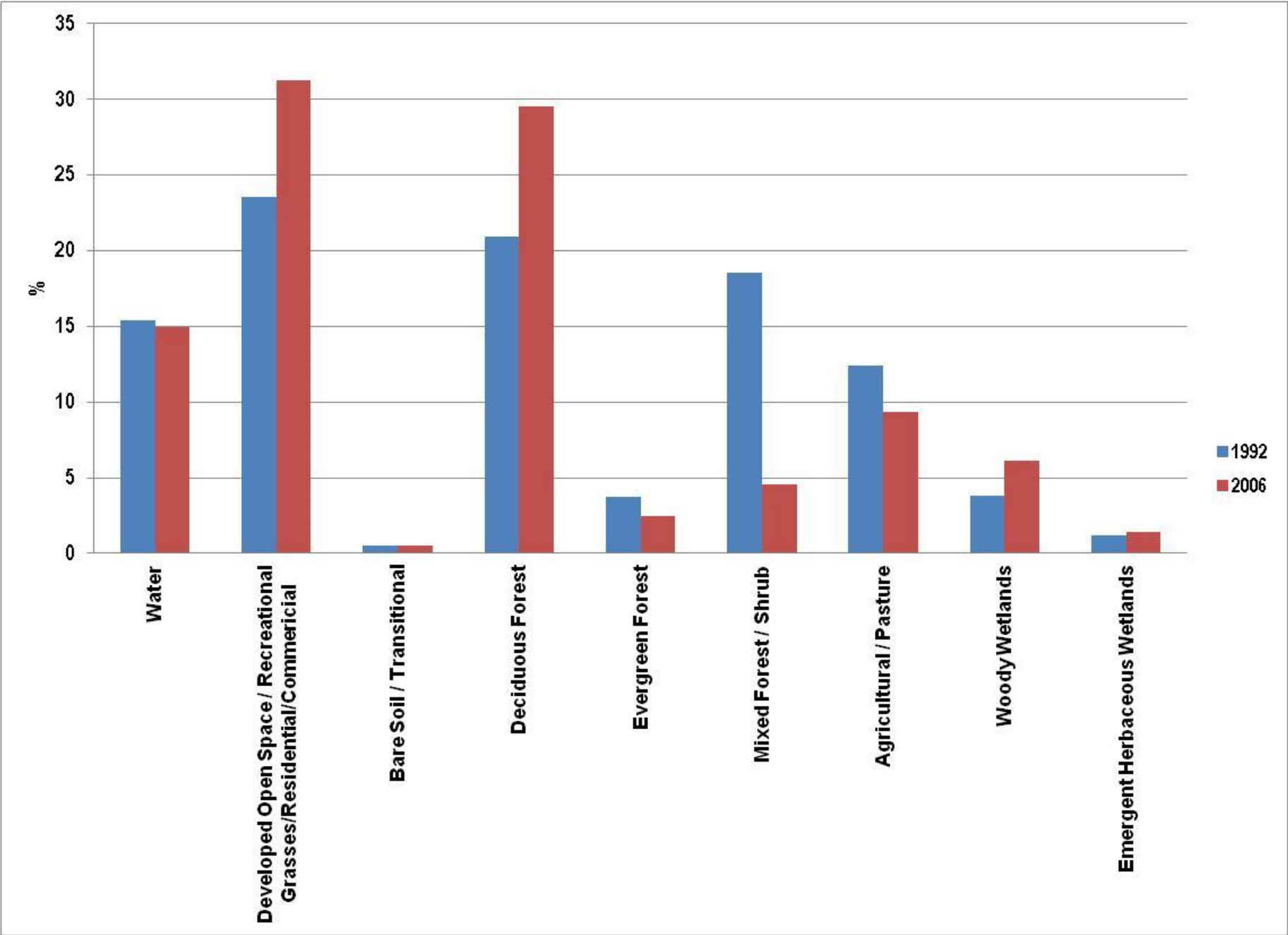


2006

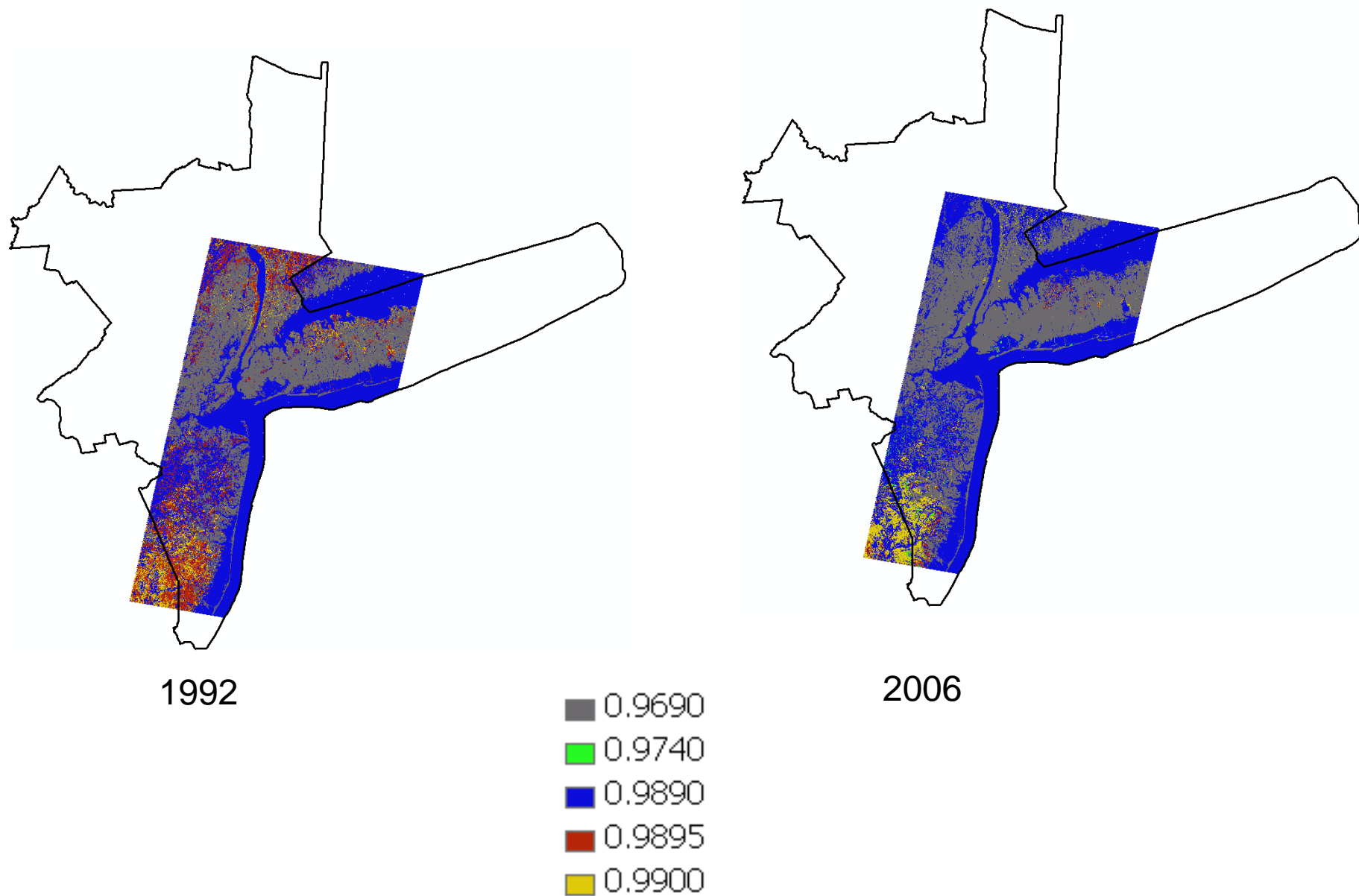
- Water
- Developed Open Space/Recreational Grasses/Low Intensity Residential
- Bare Soil / Transitional
- Deciduous Forest
- Evergreen Forest
- Mixed Forest / Shrub
- Agricultural / Pasture
- Woody Wetlands
- Emergent Herbaceous Wetlands



**Landsat-derived land cover - New York City metropolitan Area for 1992 and 2006**

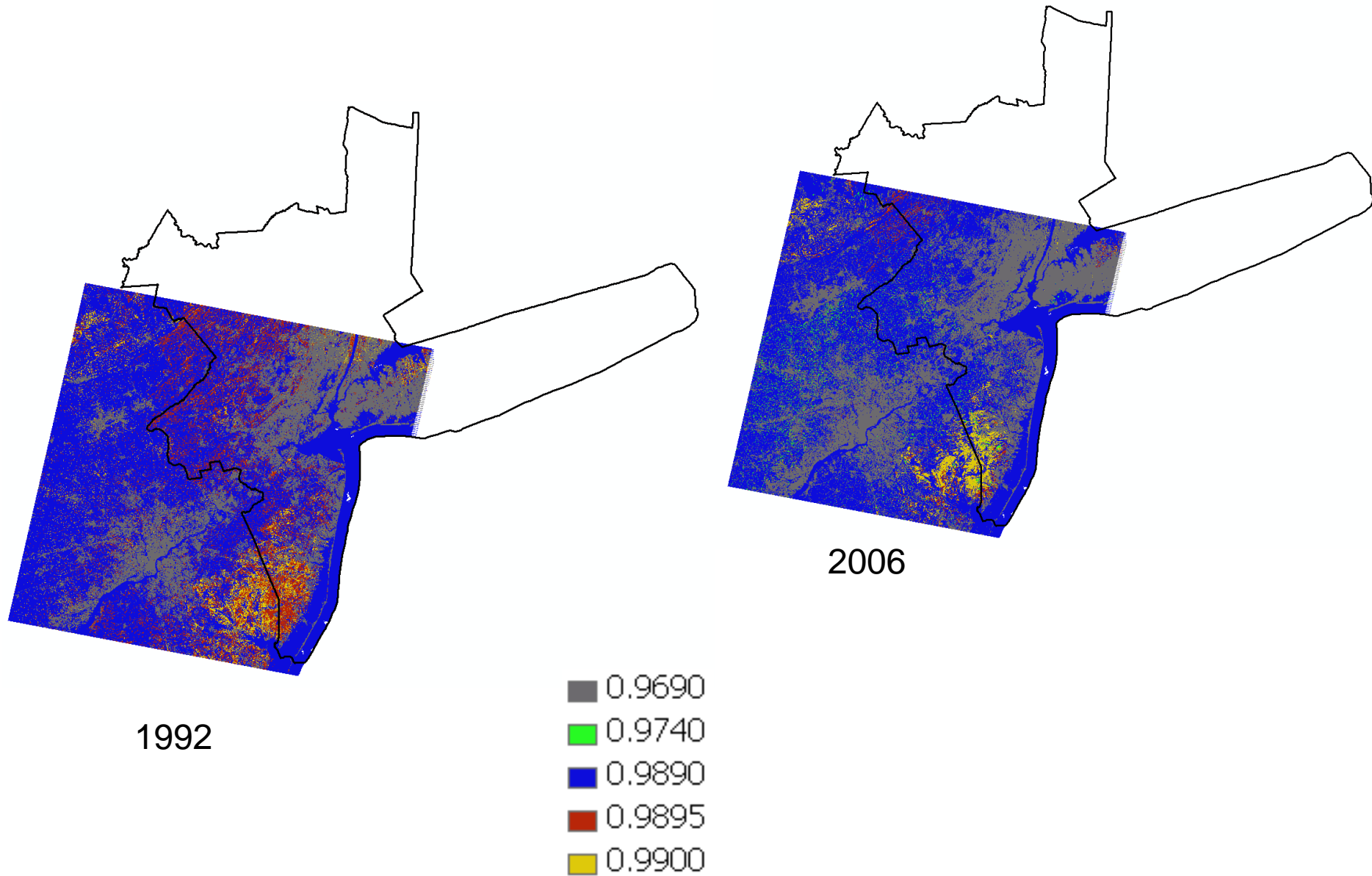


# Landsat-derived Emissivity for 1992 and 2006 – New York City East Tile

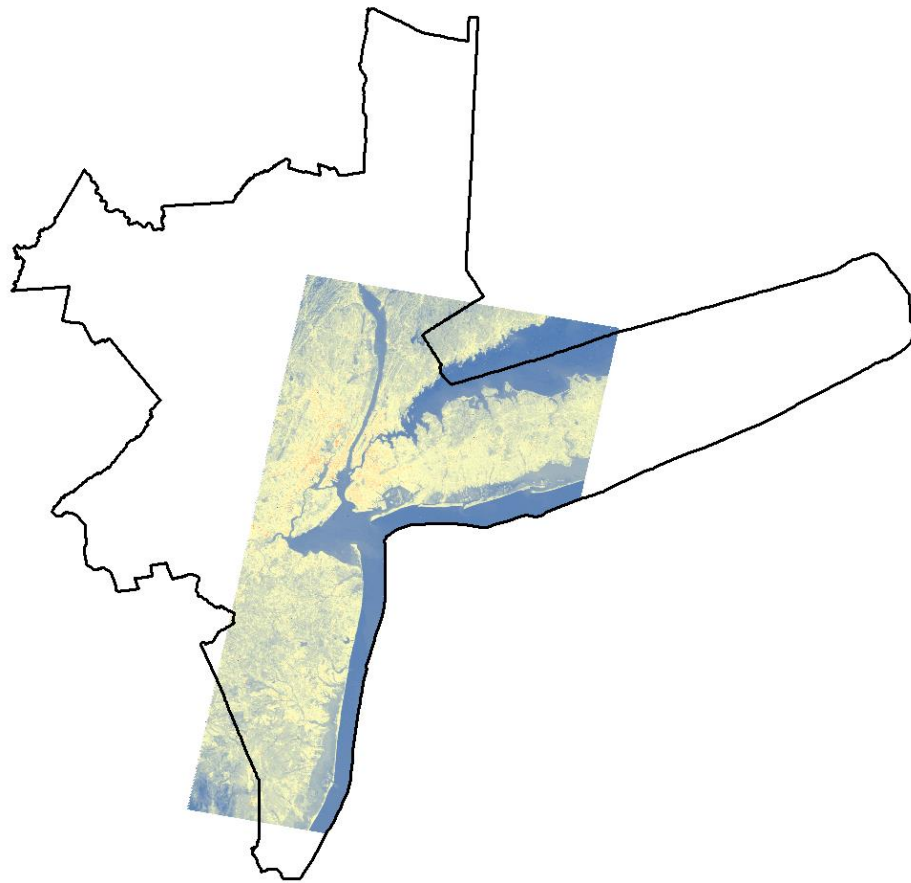




# Landsat-derived Emissivity for 1992 and 2006 – New York City West Tile

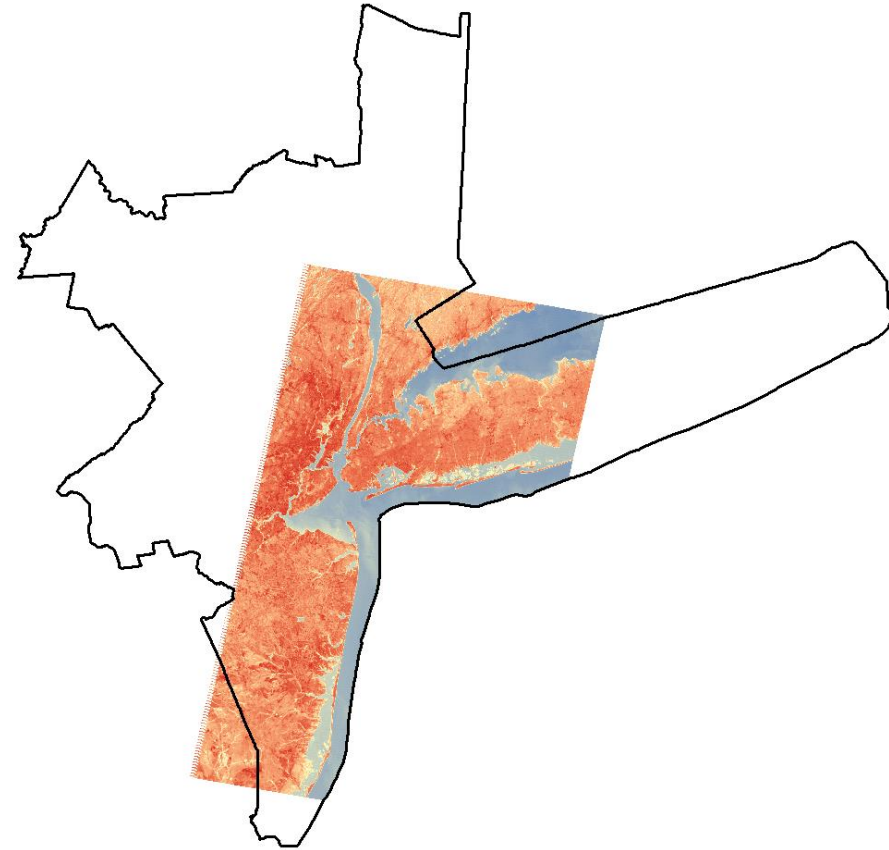


# Landsat-derived LST April 11, 1991 – New York City East Tile



1992

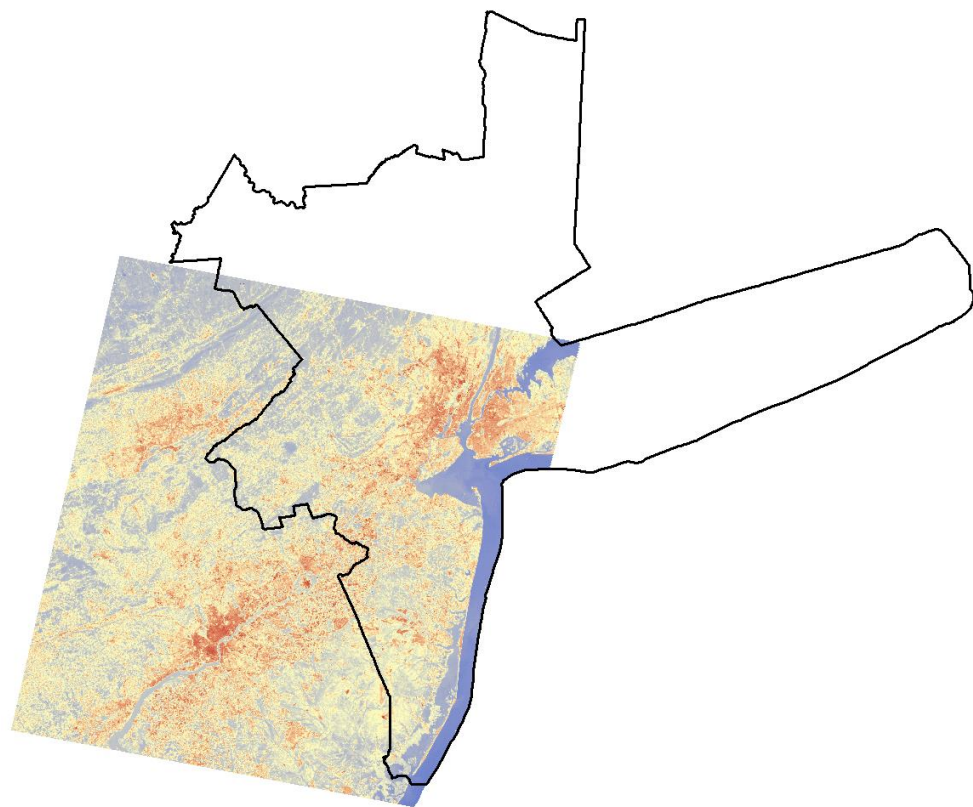
LST (K)



2006

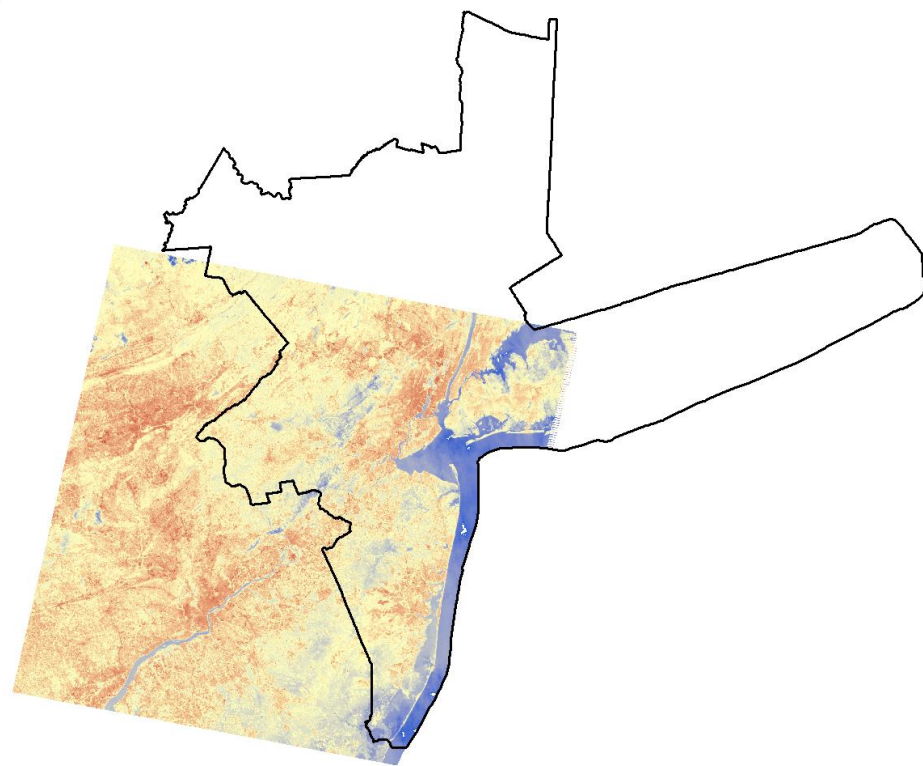


# Landsat-derived LST May 20, 1991 – New York City West Tile



1992

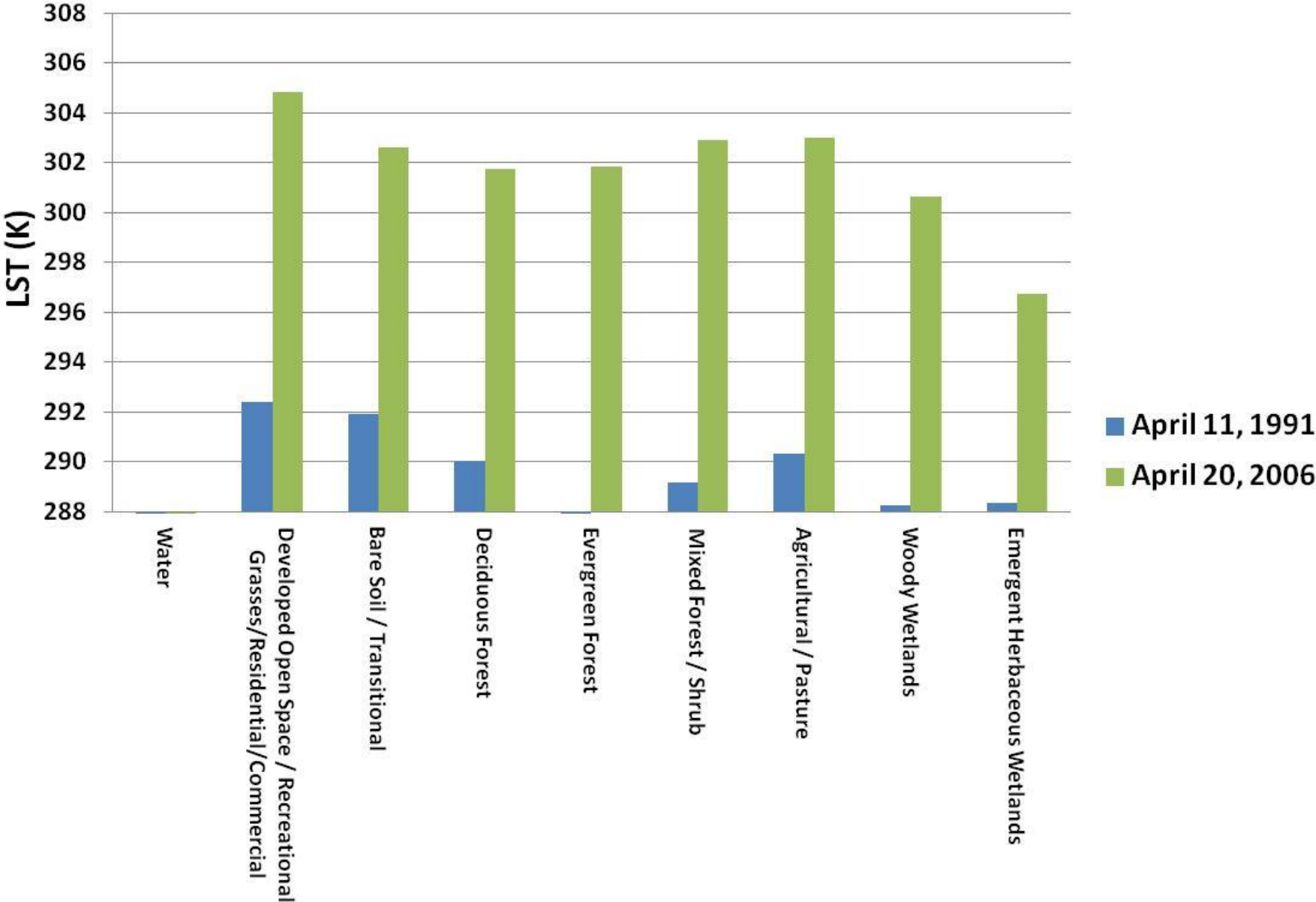
LST (K)



2006

# New York City - East Tile

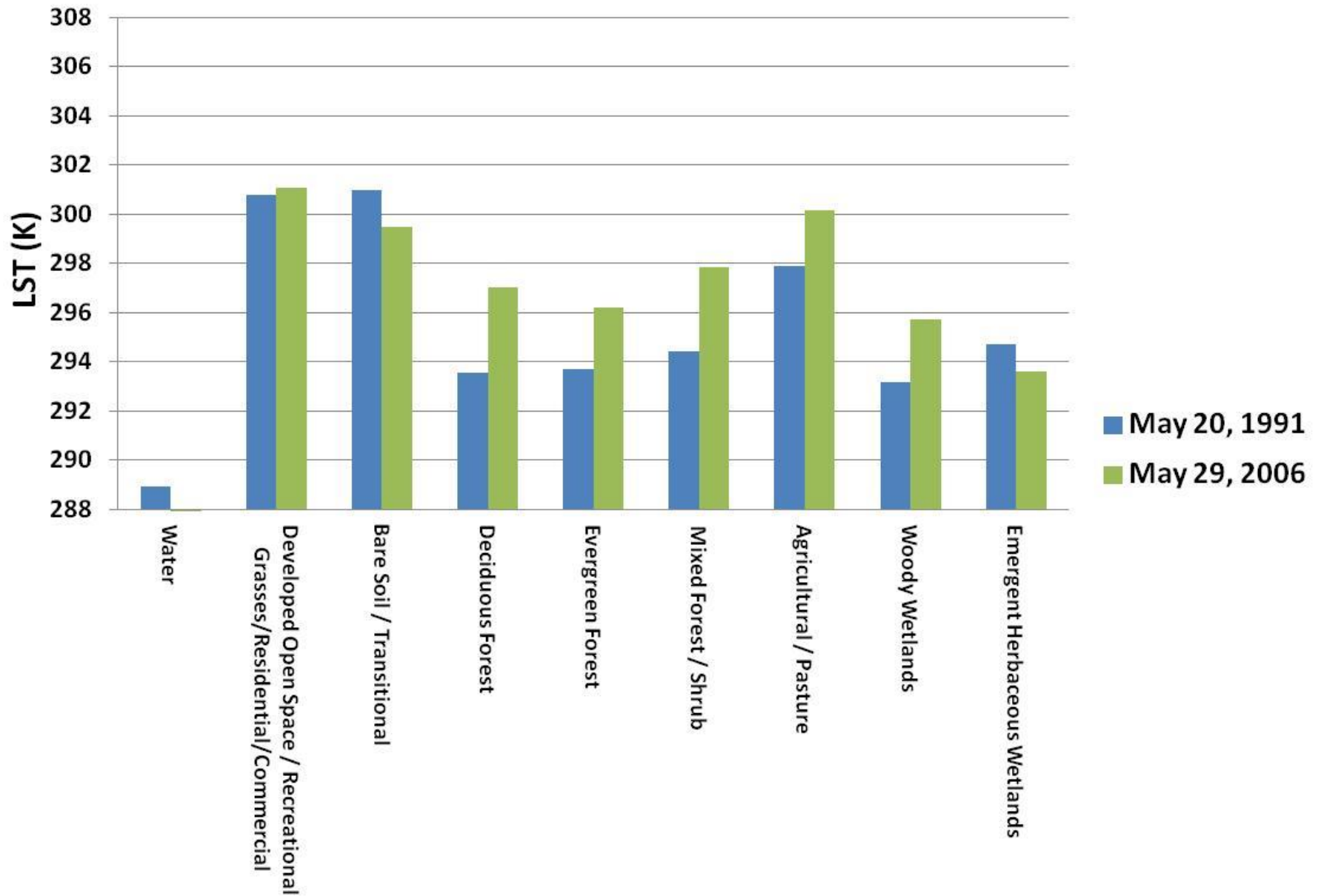
Spatial Mean Landsat-derived LST Per LCLU Class





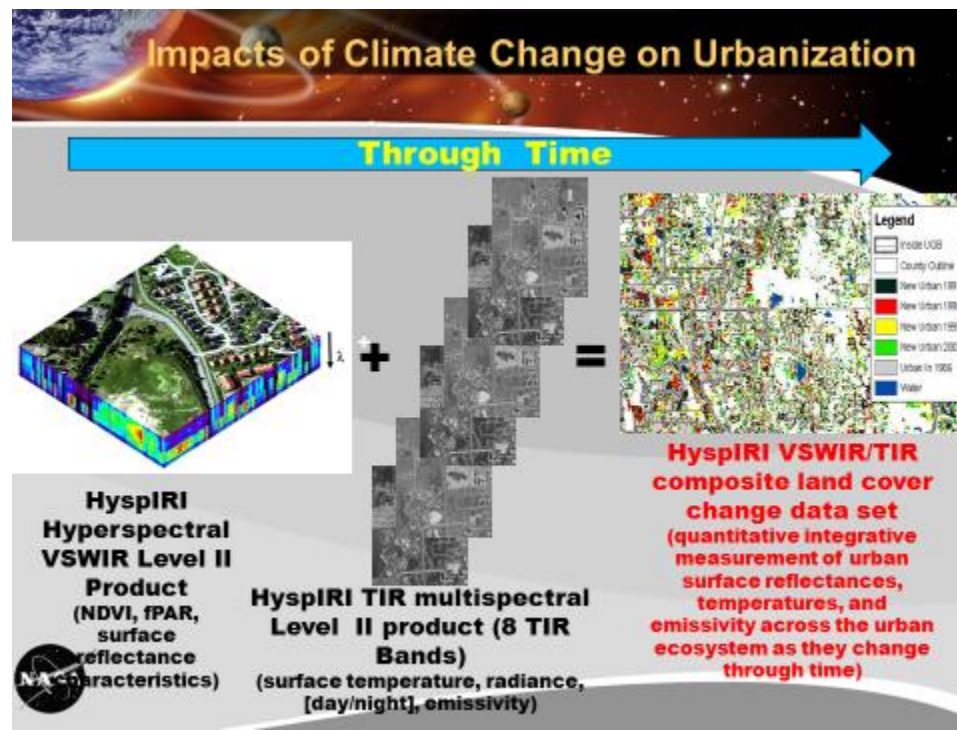
# New York City – West Tile

## Spatial Mean Landsat-derived LST Per LCLU Class



# Summary

- SB-04 will offer the opportunity to collect and access satellite data from many different international Earth observation platforms for developing a better understanding of urban land cover/land use change dynamics.
- This will offer a multiscaled approach (spectral, spatial, and temporal) that is not currently available because the data from different satellite systems are not integrated into a system that can be easily accessed.





- These data will be of immense importance in developing a better understanding of the urban ecosystem and how the cycling of land-atmosphere interactions comes together to form the 'urban atmosphere'.
- Within this purview, we will have a multitude of satellite data types that can be used to better observe, measure, and model the components that drive the UHI at local, regional, and global scales.
- These data will also be extremely important in evaluating how global climate change will impact urban areas, and provide policy and decision-makers with data and models that can be used to mitigate and adapt to climate change at the urban level.

# Landsat-derived LST for the Atlanta metropolitan area for 1992 and 2006

## Spatial Mean Landsat-derived LST Per LCLU Class

